

MTPC2007 IRON MAKING AND STEEL MAKING (3-0-0)

Course Objective:

1. To understand the various processes used for iron making and the raw material characteristics required
2. To learn about the process of steel making

Module I (6 Hrs)

Raw materials and their properties: Iron ores, Limestones, Agglomerates and Coke. Preparation of ores : Sintering and palletizing, blast furnace burdening and distribution, testing of raw materials for blast furnace, material balance. Design : Blast furnace profile, stove and gas cleaning units; instrumentation, refractory used in blast furnace and stove. Reactions in stack, bosh and hearth; formation of primary slag, bosh slag and hearth slag. Irregularities in blast furnace operation and their remedies.

Module II (6 Hrs)

Process Control: Factors affecting fuel consumption and productivity, Recent developments in Blast furnace operations like, Bell-less top charging system, High top pressure, Humidified & Oxygen enriched blast and Auxiliary fuel injection through tuyers. Alternative routes of iron making: Introduction, Processes of Sponge Iron production; SL/RN, MIDRES, HyL processes. Smelting Reduction Processes; COREX, ROMELT.

Module III (6 Hrs)

Introduction: History of steel making, principles of steel making reactions viz. decarburization desulphurization, dephosphorisation, silicon and manganese reactions. Slag theories: Molecular and ionic theories; interpretation of the above reactions in terms of ionic theory of slags.

L.D. Process: Design of converter and lance; quality of raw materials charged, operation, control of bath and slag composition, chemical reactions involved, temperature and residual bath oxygen control, use of oxygen sensor; some characteristics of L.D blow viz. emulsion formation, slopping, lance height for dephosphorisation and decarburization. Catch Carbon technique.

Module IV (6 Hrs)

Electric arc furnace: Advantages, charging, melting and refining practices for plain carbon and alloy steel; uses of DRI in arc furnace and its effect on performance, water cooled panel and computer control. Combination of blast furnace: EAF Duplex processes of stainless steel making using VOD, AOD and CLU.

Module V (6 Hrs)

Deoxidation of liquid steel: Requirements of deoxidizers, deoxidation practice, stoke's law, use of complex deoxidizers. Inclusions and their influence on quality of steel. Killed, semi-killed and rimming steel. Secondary refining of steel: Objectives; principles of degassing different industrial process such as DH, RH, VAD, LF and ESR; limitations and specific applications. Continuous Casting of steel: Advantages; types of machines; mould lubrication and reciprocation. Development in C.C.

Course Outcome:

CO1: Students will understand the preparation, testing, and reactions of raw materials in blast furnace operations and learn to address operational irregularities.

- CO2: Students will understand advancements in blast furnace operations and alternative iron-making processes, including smelting reduction and sponge iron production techniques.
- CO3: Students will understand the principles and reactions of steel-making processes, slag theories, and operational control in the L.D. process.
- CO4: Students will understand the advantages, practices, and processes of electric arc furnace operations, including the use of DRI, water-cooled panels, computer control, and duplex processes like VOD, AOD, and CLU for stainless steel making.
- CO5: Students will understand deoxidation, secondary refining processes, and continuous casting methods to enhance steel quality and industrial applications

Text Books:

1. Ironmaking and Steelmaking Theory and Practice by A. Ghosh and A. Chatterjee, PHI.
2. An Introduction to Modern Iron Making by R.H. Tupkary, V.R. Tupkary, Khanna Publication.
3. Steel Making by A.K. Chakravorty, PHI.
4. Introduction to Modern Steel Making by R.H. Tupkary, Khanna Publishers, New Delhi, 1977.

Reference Books:

1. Anil K. Biswas, Principles of Blast Furnace Iron Making, SBA Publication, 1999.
2. David H. Wakelin (ed.), The Making, Shaping and Treating of Steel (Iron Making Volume), The AISE Steel Foundation, 2004.
3. R. H. Tupkary and V. R. Tupkary, An Introduction to Modern Iron Making, Khanna Publication.
4. A. K. Chakravorty, Steel Making, PHI.